

REMARKS

Claims 4-6, 8, 10, 19, 21, 22, and 30-32 have been indicated as containing allowable subject matter.

The Office Action states that claims 1-4, 7, 9, 25, 26, 28, and 29 stand rejected under 35 U.S.C. § 102(e) for anticipation by U.S. Patent No. 6,227,433 to Waldron et al. This is inconsistent with the indicated allowability of claim 4, therefore it is assumed that claim 4 is not rejected.

Claims 11-17 stand rejected under 35 U.S.C. § 103(a) for obviousness over the Waldron patent in view of U.S. Patent No. 6,213,379 to Takeshita et al. Claims 12 and 14-17 stand rejected under 35 U.S.C. § 103(a) for obviousness over the Waldron patent in view of U.S. Patent No. 5,460,317 to Thomas et al. Claims 18, 20, and 23 stand rejected for obviousness over the Waldron et al. patent in view of U.S. Patent No. 6,050,474 to Aota et al. Claims 24 and 27 stand rejected under 35 U.S.C. § 103(a) for obviousness over the Waldron et al. patent in view of U.S. Patent No. 6,344,117 to Enomoto et al.

Applicant respectfully traverses the prior art rejections in view of the amendment to claims 1 and 29 and for the following reasons.

The present invention is directed to a method of joining a pair of metal components by friction plunge riveting. According to this method, a metal rivet is plunged into a pair of overlapping metal components. The hardness of the metal rivet is substantially similar to the hardness of at least one of the two components being joined. The metal of the rivet and the workpieces form a metallurgical bond by which the metals of each component coalesce with each other. Claims 1 and 29 are amended to specify that a metallurgical bond is formed between the rivet and workpieces. Support therefore can be found at least in paragraph 8 of the specification.

The prior art of record fails to teach or suggest these features of (1) the hardness of the metal rivet being substantially similar to the hardness of at least one of the two joined components or (2) formation of a metallurgical bond.

The Waldron patent describes the melting points of the fastener and workpieces and plasticization of the components at col. 4, lines 6-32 as follows:

The embodiments described above in connection with FIGS. 1-5 employ a fastener which is made of a metal having a melting point temperature sufficiently higher than that of the workpieces so that only the workpieces are plasticized by the frictional heating created by the rotating and advancing fastener. However, the fastener may alternatively be made of a metal having substantially the same melting point temperature as the workpieces, and indeed may be made of the identical material of the workpieces. In this case, it will be appreciated that both the workpieces and the fastener will undergo plasticization adjacent the juncture therebetween. FIG. 6 depicts the resulting weld between such a fastener 42 and the workpieces. The nominal (i.e., before plasticization) outer surface 44 of the fastener 42 is indicated by dashed lines. As can be seen in FIG. 6, the plastic zone 46 is made up of plasticized metal of both the workpieces 20, 22 as well as the fastener 42, and thus extends across the juncture defined by the nominal surface 44 of the fastener 42.

This passage demonstrates that Waldron only considered melting point, not hardness, as factor for selecting materials of the fastener and workpieces. Again, Applicants reiterate that providing for materials with the same melting point or same composition does not provide an indication of their respective hardnesses. A rivet having a hardness of at least as hard as the metal components plasticizes at a rate the same as or lower than that of the metal components. The Waldron et al. patent does not appreciate the importance of hardness to plasticization of metal that occurs in the present invention. In addition, the Waldron patent does not consider that a metallurgical bond forms between the fastener and the workpieces. At most, the reference teaches that the components plasticize, i.e. that the metals are deformed. Plasticization does not mean that the metals coalesce to form a metallurgical bond.

Applicants have discovered that the particular selection of a rivet with a hardness at least as hard as the metal components plasticizes at a rate the same as or lower than that of the

metal components and this effect is critical in forming a metallurgical bond between the rivet and components.

No such effects are produced in the method of the Waldron patent, therefore the method of claims 1-4, 7, 9, 25, 26, 28, and 29 define thereover.

With respect to the obviousness rejections of claims 11-18, 20, and 23-29, the secondary references do not account for the deficiencies in the Waldron patent namely, that the rivet has a hardness which is substantially similar to the hardness of at least one of the first and second components and that a metallurgical bond is formed between the components. Hence, claims 11-18, 20, and 23-29 define over the Waldron et al. patent in combination with the Takeshita et al., Martin et al., Thomas et al., Colligan, Aota, Cearlock et al., or Enomoto et al. patents.

The rejection of claim 7 continues to assert that col. 3, lines 54-67 or col. 4, lines 6-32 of Waldron, teaches that the final position of the pointed rivet tip is flush with the second exposed surface. Actually, the passage at col. 3 teaches against extending the fastener tip completely through the second component because the stated goal is to create an "undisturbed metal of the workpiece outside of the weld zone 32". One seeking to maintain undisturbed metal would not extend the rivet tip to the second exposed surface. The head of the fastener (opposite the tip) may be removed to be flush with the upper surface of the first workpiece, but that does not suggest altering the location of the rivet tip. The passage at col. 4 refers to Figs. 1-5 which all show the rivet tip residing completely within the second component. In the absence of any teaching that the final position of the pointed rivet tip is flush with the second exposed surface in the Waldron patent, claim 7 further defines over the prior art of record.

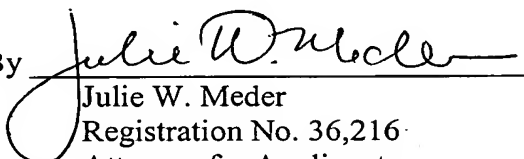
The rejection of claim 13 incorrectly asserts that the Cearlock et al. patent discloses a mechanism for collecting flash between the rivet and the first exposed surface. In fact, the Cearlock et al. patent shows a projection 19 on the tool 10 (not on a fastener) which rotates and removes flash. There is no recess formed by the fastener 42 that collects flash between the rivet and an exposed surface. Accordingly, claim 13 defines over the prior art of record.

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In view of the foregoing, claims 1-32 are believed to define over the prior art of record and be in condition for allowance. Reconsideration of the rejections and allowance of all of claims 1-32 are respectfully requested.

Respectfully submitted,

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